known because the economic value of coal has uncovered immense areas; while the Permian, Rhaetic, or Middle Triassic have depended upon the enthusiasm of about a dozen scientists. The flora of these horizons is probably as abundant and varied as that of the Carboniferous, but not so available.

In going back through the geological horizons, there is a gradual merging of Coniferophyte, Cycadophyte, and Ginkgophyte foliage toward seed-bearing "quasi-ferns." Also toward the early Paleozoic there seems to be some kind of contact between the early seed ferns and the older Lepidophyte types leading toward the primitive Gymnosperms. Whether well down in the Devonian some of the Lepidophytes, like the later seed ferns, may also have led into the primitive Gymnosperms is the real riddle of paleobotany, more so than the origin of Angiosperms. In almost all instances the doubtful border of Cycadeoid foliage ends in a tree forest of seed ferns, *Cordaites*, pines, araucarians, and Ginkgoes, but never in a recognizable scrub. It is stated that among the Cycadeoids will be found the lost forests and the greatest forest makers of the Mesozoic.

WIELAND suggests that from age to age great groups have come down side by side, undergoing endless change and losing apparent relationships; but almost no forms, scarcely a family, need be regarded as more ancient or more modern than any other. It is conceivable that all the antecedent types of Angiosperms are discrete separate lines leading back to the first forests of the Devonian.—J. M. C.

History of cotyledony.—BUCHHOLZ,[10] in connection with his studies of embryo development in conifers, has reached certain conclusions in reference to the primitive condition of cotyledony and its subsequent evolution. His investigations showed that in a number of conifers fusions of cotyledons occur during embryogeny, and that there is no evidence of splitting. Fusion results not merely in a reduced number of cotyledons, but often in the development of cotyledonary tubes. The conclusion is that the primitive gymnosperm embryo had numerous cotyledons; that fusions resulted in a reduced number; that dicotyledony was attained either by a fusion of cotyledons into two groups or by an extremely bilabiate development of a cotyledonary tube; and that monocotyledony is the result of a cotyledonary tube becoming "unilabiate" in its development. According to these conclusions, therefore, polycotyledony is primitive, dicotyledony is derived, and monocotyledony is the extreme expression of cotyledonary fusion.—J. M. C.

Life cycle of climbing bamboo.—SEIFRIZ[11] has published some observations on one of the climbing bamboos (*Chusquea abietifolia*) growing in Jamaica.

[10] BUCHHOLZ, J. T., Studies concerning the evolutionary status of polycotyledony. Amer. Jour. Bot. **6**:106–119. *figs. 25.* 1919.

[11] SEIFRIZ, W., The length of the life cycle of a climbing bamboo; a striking case of sexual periodicity in *Chusquea abietifolia* Griseb. Amer. Jour. Bot. **7**:83–94. *figs. 5.* 1920.

It is a species little known outside Jamaica, and is restricted there to the mountainous interior. It is one of the plants that live vegetatively for a number of years and then flower and die. *Agave americana* ("century plant") is the most commonly cited illustration of this habit. The bamboos are notable for this kind of periodicity, the number of years of vegetative activity before flowering varying widely in different forms. Apparently, when flowering occurs, most of the individuals of a region are involved, and presently all the mature plants are dead, and the ground occupied by seedlings. SEIFRIZ had an opportunity to observe the flowering condition of *Chusquea abietifolia* in 1918, and the records available showed that the previous flowering condition had occurred 33 years before. The explanation of this behavior is not available as yet, for seasonal factors controlling such long periods are very unlikely.—J. M. C.

Mosaic disease of spinach.—Investigations of JODIDI, MOULTON, and MARKLEY,[12] of the Bureau of Plant Industry, have shown that "spinach plants, especially their tops, affected with mosaic disease, have a smaller percentage of total nitrate, acid amide, mono and diamino nitrogen, but a somewhat larger percentage of ammonia than normal plants, nitrous acid being present in diseased plants only. This is due to the fact that denitrification takes place whereby nitrates are reduced to nitrites which, reacting on various nitrogenous compounds present in the spinach, bring about elimination of nitrogen in a free state, involving also loss of nitrogen in the form of ammonia."

It will be very interesting to know how generally in physiological diseases of plants and in viris and other disorders denitrification is involved.[13]—WM. CROCKER.

Leaching of nitrates.—Working with uncropped and unmanured soils RUSSELL and RICHARDS[14] conclude that "the nitrate in drainage water accounts for practically all the nitrogen lost from the soil. The uncertainty attaching to the estimated figures and to the actual amount of new nitrogen in the rainfall deprives the balance sheet of precision, but there is no room for much fixation or loss of gaseous nitrogen. The chief, if not the sole action, in this soil when there is no manure, crop residues, or fresh supply of organic matter, is the production of nitrate. It is in these circumstances that the nitrogen cycle is seen at its simplest. We know from other Rothamsted experiments that the cycle becomes more complex when organic matter is added to the soil, both fixation and loss of nitrogen being then liable to occur."—WM. CROCKER.

[12] JODIDI, S. L., MOULTON, S. C., and MARKLEY, K. S., The mosaic disease of spinach as characterized by its nitrogen constituents. Jour. Am. Chem. Soc. **42**:1061–1070. 1920.

[13] BOT. GAZ. **65**:199–200. 1918.

[14] RUSSELL, E. J., and RICHARDS, E. H., The washing out of nitrates by drainage water from uncropped and unmanured land. Jour. Agric. Sci. **10**:22–43. 1919.